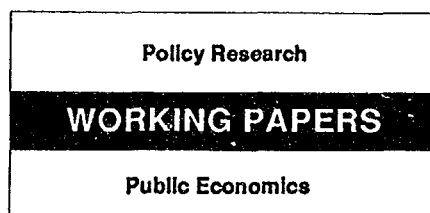


WPS 0936



Country Economics Department
The World Bank
July 1992
WPS 936

Taxation, Information Asymmetries, and a Firm's Financing Choices

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How the effects of taxation and information asymmetries influence the firm's financial decisions, and how public policy may affect all three.

This paper — a product of the Public Economics Division, Country Economics Department — is one of a series of papers commissioned for the research project, "An Evaluation of Tax Incentives for Industrial and Technological Development," (RPO 675-10), funded by the Bank's Research Support Budget. Copies of this paper are available free from the World Bank, 1818 H Street NW, Washington DC 20433. Please contact Carlina Jones, room N10-063, extension 37699 (July 1992, 46 pages).

Lyon surveys the effects of taxation and asymmetric information on the financing of investment. In the absence of these two factors, traditional economic models predict that funds for investment flow to projects with the highest expected return. The form of the investment (for example, whether by equity, bank loan, or another form of debt finance) is irrelevant.

In the presence of either taxation or information asymmetries, however, neither of these predictions necessarily holds. Financing may not go toward those projects with the highest expected return and the form in which the financing is conveyed can affect the profitability of the project to both the provider of funds and the recipient.

What are the policy implications of the effects of these factors on the financing of investment?

- Depending on technological characteristics, informational asymmetries can result in either overinvestment or underinvestment in an economy. Clearly, depending on which outcome occurs, policy recommendations to correct the inefficiency differ. While persistent overinvestment is unlikely to characterize most developing economies, there are certainly many occasions when funds are applied to projects with low expected returns.

- Increases in the level of wealth and collateral in an economy can greatly reduce the costs of asymmetric information. Increases in collateral reduce the risks faced by lenders. Entrepreneurs with poor projects are less likely to undertake them when they must risk more of their own wealth. Government policies that increase the ability of individuals to collateralize wealth — for example, by promoting property rights and the establishment of a legal system that allows the low-cost transfer of collateral — can increase the ability of potentially successful projects to receive financing. Policies that facilitate the ability of individuals to accumulate savings play a

related role. In addition to increasing the collateral of an entrepreneur, the ability to earn high rates of return increases the opportunity cost of undertaking projects with low expected returns.

- Creating decentralized securities markets is likely to be less advantageous where information asymmetries are great. Individual providers of funds have an incentive to free-ride on the information and monitoring of entrepreneurs provided by others. Only firms with established reputations may be able to obtain funds in these markets.

- Similarly, while competition among lenders is generally promoted, such competition can also reduce the incentive for individual lenders to lend to entrepreneurs where information and monitoring costs are large. Competitors would attempt to "steal" these borrowers away after they were certified as creditworthy. Further, limited competition allows a lender to use the sanction of denying credit as an instrument to influence borrowers to act responsibly in order to obtain future financing.

- As the result of information asymmetries, certain types of projects are more likely to obtain financing at a lower cost using equity finance rather than debt. If the tax costs of equity are higher than those of debt, however, these projects may be relatively underfinanced. Tax policy might wish to consider whether the tax treatment of equity and debt should be equalized or whether tax costs of these projects can be reduced in other ways.

- Government may feel an obligation to intervene directly in credit allocation, but should do so only where it has a greater ability to identify creditworthy recipients than other lenders do. In the absence of any comparative advantage, government attention to the basic infrastructure that reduces the costs of obtaining information and enforcing contracts is likely to better assist the efficient allocation of credit.

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*This is one of a series of papers commissioned by the Tax Incentives Evaluation Research Project of the Public Economics Division of The World Bank. The project is directed by Anwar Shah.

I wish to thank Karla Hoff for many useful suggestions and especially Anwar Shah for his guidance of this project.

This paper presents a survey of the effects of taxation and asymmetric information on the financing of investment. In the absence of these two factors, traditional economic models predict that funds for investment flow to projects with the highest expected return. The particular form in which the investment occurs (for example, whether by equity, bank loan, or other form of debt finance) is irrelevant. In the presence of either taxation or information asymmetries, however, neither of these predictions necessarily holds. Financing may not go toward those projects with the highest expected return and the form in which the financing is conveyed can affect the profitability of the project to both the provider of funds and the recipient.

Under a classical corporate income tax, dividends, retained earnings, and debt are all treated differently. Firms are expected to adopt the form of finance with the lowest tax costs. If all firms do not have equal access to the lowest cost source of funds, however, investment may fail to go toward those projects with the highest returns. Firms may find that certain projects that would have been profitable to undertake using one source of funds are unprofitable using other sources of funds due to the higher tax costs. These tax costs become barriers to the efficient allocation of capital across firms.

Asymmetric information presents a different type of barrier to the efficient allocation of capital. Ultimately the provider of funds for an investment project can never know as much about the project as the entrepreneur undertaking the activity. The entrepreneur has some scope to change the riskiness of a project's returns in unobservable ways and has the ability to pursue other activities which benefit only himself (e.g., leisure). Since the entrepreneur's actions are not fully observable (or could only be observed at high cost), contracts cannot be enforced which dictate under all possible contingencies how the entrepreneur is to perform. Instead, as in other principal-agent problems, the provider of funds must find indirect means to influence the behavior of the entrepreneur. The method

of financing is an important instrument in guiding the behavior of the entrepreneur under asymmetric information.

The effects of these factors on the financing of investment have numerous policy implications:

- Depending on technological characteristics, informational asymmetries can result in either over-investment or under-investment in an economy. Clearly, depending on which outcome occurs, policy recommendations to correct the inefficiency differ. While persistent over-investment is unlikely to characterize most developing economies, there are certainly many occasions when funds are applied to projects with low expected returns. The possibility that an increased availability of funds will result in misdirected investment cannot be ignored.
- Increases in the level of wealth and collateral in an economy can greatly reduce the costs of asymmetric information. Increases in collateral reduce the risks faced by lenders. Entrepreneurs with poor projects are less likely to undertake them when they must risk more of their own wealth. Government policies which increase the ability of individuals to collateralize wealth, for example by promoting property rights and the establishment of a legal system that allows the transfer of collateral at low cost, can increase the ability for potentially successful projects to receive financing. Policies which facilitate the ability of individuals to accumulate savings play a related role. In addition to increasing the collateral of an entrepreneur, the ability to earn high rates of return increases the opportunity cost of undertaking projects with low expected returns.
- The creation of decentralized securities markets is likely to be less advantageous where information asymmetries are large. Individual providers of funds have an incentive to free-ride on the information and monitoring of entrepreneurs provided by

others. Only firms established reputations may be able to obtain funds in these markets.

- Similarly, while competition among lenders is generally promoted, such competition can also reduce the incentive for individual lenders to loan to entrepreneurs where information and monitoring costs are large. Competitors would attempt to "steal" these borrowers away after they were certified as creditworthy. Further, limited competition allows a lender to use the sanction of denying credit as an instrument to influence borrowers to act responsibly in order to obtain future financing.
- As the result of information asymmetries, certain types of projects are more likely to obtain financing at a lower cost using equity finance rather than debt. If the tax costs of equity are higher than those of debt, however, these projects may be relatively underfinanced. Tax policy might wish to reconsider whether the tax treatment of equity and debt should be equalized or whether tax costs of these projects can be reduced in other ways.
- While government may feel an obligation to intervene directly in credit allocation, any such intervention should only occur where government has a greater ability to identify creditworthy recipients than other lenders. In the absence of any comparative advantage, government attention to the basic infrastructure which reduces the costs of obtaining information and enforcing contracts is likely to better assist the efficient allocation of credit.

I. Introduction

This paper is intended as a survey of the effects of taxation and asymmetric information on the financing choice of the firm. The literature on taxation posits a straightforward relationship between the pretax cost of funds and the required return on an investment project to cover the cost of finance which is a function only of tax rates. The real decisions of the firm are assumed in these analyses to be affected only by the after-tax cost of funds.

An alternative literature has focused on how the choice of financing can influence the real decisions of the firm. At least since Adam Smith, economists have recognized how managerial incentives may differ with outside ownership of the firm.¹ Two problems face outside debt and equity investors. First, there is an inability to monitor completely the activities of the firm's managers. Second, outside investors are less informed than the firm's managers as to the profitability of alternative actions. These monitoring and information problems affect the financing of enterprises ranging in scale from multinationals to single entrepreneurs. When there are outside equity holders, management may have a reduced incentive to take actions that maximize firm value. This occurs because management bears the full cost of increasing its managerial effort, yet receives only a portion of the benefit from this effort. With debt finance, management may pursue excessively risky projects. Management captures the full marginal return to additional profit of successful projects but may bear no marginal loss in unsuccessful projects. Projects with extreme variance in outcomes may then be favored.

Outside investors are aware that management has the incentive to undertake activities that fail to maximize investors' wealth. Investors will factor these deviations into the price they will be willing to pay for the firm's equity or the terms under which they will lend money to the firm. As a result,

¹Jensen and Meckling (1976) cite a particularly relevant passage from Adam Smith's The Wealth of Nations (1776): "The directors of such [joint-stock] companies, being the managers rather of other people's money than of their own, it cannot well be expected that they should watch over it with the same anxious vigilance with which the partners in a private copartnery watch over their own."

expected deviations from firm value maximization are at least partly borne by the management.

It would be in the interest of management to contract with the outside investors to operate the firm in the same manner as they would without outside ownership. However, unless outside investors have complete information on all of the activities of the managers, this contract is not enforceable. In the absence of the ability to convey symmetric information to potential investors, managers bear additional costs when outside finance is obtained.

The divergence in the cost of internal and external sources of finance may affect the efficiency with which investment is allocated. Firms with access to sufficient internal funds or external funds without significant agency costs may be able to undertake all investment opportunities with positive net present value. Other firms, however, may face a divergence between the required return on internal funds and that required on external funds due to asymmetric information. In this case, investment opportunities which would be profitable to undertake with internal funds may not yield sufficient returns to allow external financing. Investment is misallocated because projects with high marginal returns may not receive financing, while projects available to firms with lower marginal returns are undertaken. Further, the wrong amount of investment may be undertaken.

The next section of this paper examines how differential taxation of retained earnings, new share issues, and debt finance affects the financing choice of the firm in the absence of asymmetric information. Section III examines the problems of asymmetric information that arise with external finance. Section IV briefly examines mechanisms that have been created in rural sectors of developing countries to counter the problems of asymmetric information. The final section of the paper examines policy options open to government to reduce the costs of the inefficiencies created by asymmetric information. Unfortunately, policy prescriptions appear to be very dependent on the form of the information asymmetry. General government solutions to the problem of asymmetric information may not be possible without a precise understanding of the nature of the information problem.

II. Debt, Equity, and Taxes Under Symmetric Information

A corporation can finance its initial investment by issuing either equity or debt. Equity represents ownership in the corporation. An equity investor receives a proportionate share of an uncertain future stream of income from the corporation. Assuming limited liability, the equity owner's potential loss is limited to the amount invested in the corporation. Debt represents a promise of a fixed payment to the lender. If the corporation defaults on this promise, the firm may be liquidated. The proceeds of the liquidation are paid to the firm's lenders up to the amount of the promised payment. If the liquidation payment is less than the promised payment, the lenders bear the loss.

These two different financing options have quite different return characteristics. Even in the absence of the confounding effects of taxation, one might expect that there is an optimal ratio of debt and equity for a firm -- that is, some optimal mixture of debt and equity which maximizes the value of the firm. A surprising result of the Modigliani-Miller (1958) theorem, however, is that the value of the firm is independent of the choice of financing. This fundamental theorem of corporate finance was derived in the absence of tax effects and assumes that the real activity of the firm is independent of its financing choice.

In the presence of taxes this result may no longer be true, as shown in a subsequent paper by Modigliani and Miller (1963). The analysis of this section will first examine the initial financing choice of a firm in the presence of taxes. This analysis is developed along the lines of Modigliani and Miller (1958, 1963) and Miller (1977). Next, the role of retained earnings, a source of finance not available for the initial investment of the start-up firm, will be considered. This analysis is intended to show how a firm would choose its mix of financing under the original assumptions of Modigliani and Miller where the real activity of the firm is not affected by the financing mix and there is no risk of bankruptcy. Section III drops these assumptions and incorporates the effects of bankruptcy and asymmetric information on the value of the firm.

A. Modigliani-Miller Theorem

Under a classical or unintegrated system of corporate taxation, debt and equity income are treated differently. In such a tax system, a corporation may deduct payments of interest from taxable income, but not payments of dividends. Interest income is taxable to the bondholder. A unit of pretax earnings of the corporation paid as interest yields net income of $(1 - \tau_b)$, where τ_b is the bondholder's tax rate on interest income. Dividend income, in addition to being taxed at the corporate level, is taxable to the stockholder. Dividend income is thus subject to a "double tax" in an unintegrated tax system.² One unit of pretax income to be distributed as a dividend is first reduced by corporate tax payments τ_c , and the remainder is then taxed at the stockholder tax rate τ_d . The net income to the dividend recipient is $(1 - \tau_c)(1 - \tau_d)$ per unit of pretax earnings.

Corporate income net of corporate taxes and net of payments of interest, principal, and dividends are retained by the firm. These retained earnings result in an appreciation in the value of the corporation. The appreciation is taxable as capital gains income to the shareholder. In many tax systems, capital gains are taxed at a reduced statutory rate relative to dividend and interest income. Even in the absence of an explicit statutory rate reduction for capital gain income, capital gains face a lower effective tax rate than dividend income. This is because capital gains are generally taxed only when the stock is sold, rather than as the gains accrue. The deferral of taxation is equivalent to a rate reduction. The longer the period of time between the date of accrual and the date of realization, the greater is the equivalent rate reduction.³ We can define τ_{re} as the tax rate at the shareholder level on retained earnings that would result in the same present value of tax collections as a capital gains tax paid when stock is sold.

²A fully integrated tax system gives a dividend recipient credit for income taxes paid by the corporation. In this case the original Modigliani-Miller result found in the absence of taxation (indifference between debt and equity) holds.

³Capital gains not realized before death of the stockholder may even escape taxation entirely, as in the U.S. The heir may be liable only for tax on the appreciation of the stock from the date the stock was inherited.

Assuming a constant ratio of dividend payments to retained earnings, the effective rate of taxation of equity income at the shareholder level can be considered a weighted average of the effective tax rates applying to dividends, τ_d , and capital gains, τ_{re} . Assume that the corporation chooses a dividend payout ratio which results in an overall effective rate of taxation of τ_e on equity income, where $\tau_e = \beta\tau_d + (1-\beta)\tau_{re}$ and β is the proportion of the firm's after-tax earnings paid as dividends.⁴

Let us consider the effect of the differential rates of taxation on debt and equity income on the initial financing choice of the firm. Assume initially that the investment project has a certain return. One can solve for the relationship between the pretax returns this project must have to satisfy bondholders (r_b) or equity holders (r_e). If the entire project is financed with debt, no corporate tax liability will be assessed (since debt payments are deductible from corporate income), and after-tax income of bondholders is $r_b(1 - \tau_b)$. Alternatively, if the project is financed with a new equity issue, both corporate and personal taxes are paid on the income generated by the investment, yielding after-tax income of $r_e(1 - \tau_c)(1 - \tau_e)$ to the shareholders. The source of financing which results in the highest after-tax return will be chosen. Investors are indifferent to the source of financing if and only if $r_b(1 - \tau_b) = r_e(1 - \tau_c)(1 - \tau_e)$. If we assume the pretax income of the project is independent of its source of financing ($r_b = r_e$), debt will be preferred if the tax burden on interest income, τ_b , is less than the total of corporate and shareholder level taxes paid on equity income, $\tau_c + \tau_e(1 - \tau_c)$. Alternatively, if $(1 - \tau_b) < (1 - \tau_c)(1 - \tau_e)$, then investors' incomes are maximized by the firm issuing equity.

Modigliani-Miller show that this same inequality governs the choice between debt and equity when the return to equity income is uncertain, provided there is no risk of bankruptcy. Modigliani-Miller propose how a shareholder can borrow on his or her own to create an earnings stream from an unlevered firm that is identical to that (in expectations) from a levered firm of the same risk. (A demonstration is

⁴Section I. C will examine what factors a firm may consider in choosing whether to retain earnings or pay income as dividends. For now, we will ignore how this choice is made.

given in Appendix A.)

The Modigliani-Miller proof suggests that under many plausible values for tax variables, a firm could increase its value by increasing its leverage. In the extreme, a firm would be almost entirely debt financed, except for some residual equity.

B. Miller Equilibrium

Miller (1977) suggests a slightly different equilibrium relationship between debt and equity. In this equilibrium, there is a unique economy-wide optimal debt-equity ratio, yet no firm has an incentive to alter its own debt-equity ratio.

Miller notes that under a progressive tax system there is a wide range of potential tax rates on each source of financing. For tax-exempt investors, $\tau_b = \tau_e = 0$. Other investors may face high tax rates on interest income, such that $\tau_b > \tau_e$. Preferential tax treatment of capital gains may result in a higher after-tax return from corporate equity than from debt for these investors.

Let r be the pretax return on a project to be funded. Assuming the returns from both debt and equity are certain, investors will prefer the source of finance with the higher after-tax return. Both equity and debt will be issued in equilibrium if there are some investors who receive a higher after-tax return by lending and others who receive a higher return by purchasing equity. There may exist a marginal investor who is just indifferent between holding debt and equity. For this marginal taxpayer, $(1 - \tau_b^*) = (1 - \tau_e^*)(1 - \tau_c^*)$, where the asterisk denotes the tax rate of this investor. The economy-wide ratio of debt and equity is determined by the quantity of investment undertaken by individuals with tax rates above and below the marginal investor. For investors with low tax rates, it is likely that $(1 - \tau_b) > (1 - \tau_e)(1 - \tau_c)$. These investors will prefer debt to equity. Investors in high tax brackets may find the inequality reversed, and prefer holding equity to debt. Debt issued by the corporate sector is purchased by taxpayers in increasingly higher tax brackets. Equilibrium is achieved when the amount of investment in the economy is financed at its lowest possible cost. This will result in a unique debt-equity ratio for

the economy, but there is no advantage to any firm from changing its own debt-equity ratio.

When Miller proposed this equilibrium theory of finance the United States had personal tax rates on interest income as high as 70 percent, while the tax rate for large corporations was 48 percent. These high tax bracket investors may have received a higher after-tax return through equity rather than debt. Subsequent tax changes in the U.S. in 1981 and 1986 lowered the rate of individual taxation relative to that of corporations. By 1986, the highest personal tax rate on interest income was less than the statutory corporate tax rate. As a result, the Miller equilibrium would now suggest a greater reliance on debt finance for newly established firms.

C. The Financing Choice of Existing Firms

The analysis of Modigliani-Miller (1958) and Miller (1977) can be viewed as an analysis of the choice of the optimal initial capital structure when the firm is first founded. If there is any equity at the time the corporation is first established, however, retained earnings may be an additional source of financing available to the firm when subsequent financing is needed.

Stiglitz (1973) suggests a life-cycle view of a firm. In return for contributing an initial idea of value, the founder of a corporation receives an equity share in the firm. The firm requires additional external funds to undertake the investment necessary to carry out this idea. Whether to finance this investment through debt or new shares is the focus of Modigliani-Miller (1958, 1963) and Miller (1977).

In subsequent periods, earnings of the initial investment may exceed interest payments on the firm's debt. These earnings constitute a third source of finance for further investment. The firm has three financing possibilities now: retained earnings, new share issues, or debt. King (1977) examines the consequences of the use of these alternative sources of finance.

King considers the real investment of the firm constant under each financing choice. Thus, a decision to reduce the use of retained earnings this period, requires either an increase in new share issues

or an increase in borrowing to keep investment constant. Each of these policies, while not affecting the real investment of the firm, alters the time path of dividends paid per share of stock, and therefore will in general affect the share value of the firm. King examines the effects of small perturbations in the use of these sources of finance on share value. The firm is assumed to choose the source of finance which maximizes the current share value of the firm.

Consider the decision by the firm to increase the use of new share issues this period and reduce retained earnings by an equal amount, holding the firm's debt policy unchanged. This causes dividends to increase in the present period. In all subsequent periods, the total amount of dividends paid by the firm will be the same as without the perturbation. Dividends per share, however, will be lower because the firm's earnings are now distributed among a larger number of shares. If the after-tax present value of the flow of income per share is higher under this policy than the alternative, then share value will be maximized by adopting the policy. King (1977, ch. 4) shows that the policy of new share issues will be preferred to the use of retained earnings only if $\tau_d < \tau_{re}$. This is because a unit of earnings retained by the firm results in tax liability of τ_{re} . A unit of earnings paid in dividends causes tax liability of τ_d . Assuming τ_{re} is never greater than τ_d , the firm will always prefer the use of retained earnings to new share issues.

If retained earnings are always preferred to new share issues, then it is worthwhile for the firm to reduce new share issues to zero. Similarly, if the firm has retained earnings in excess of current investment needs, the firm could reduce shareholder tax liability by repurchasing shares rather than paying dividends. Stiglitz (1973), King (1977), and Auerbach (1979) suggest that there may be legal restrictions on the ability of firms to regularly repurchase shares in lieu of paying dividends.⁵ With restrictions on share repurchases, a firm with no investment opportunities and positive earnings could

⁵In the U.S., the effect of the legal restrictions are unlikely to constrain most firms. The presence of dividend payments is then likely the result of non-tax factors that are omitted from this analysis.

acquire other companies as a means of disbursing the earnings in a manner creating capital gains rather than dividend tax liability. Finally, if there are restrictions on the acquisition of other firms, a firm will only pay dividends if a unit of retained earnings increases share value by less than $(1 - \tau_d)/(1 - \tau_{re})$.⁶

If new share issues are kept constant, a decision to reduce retained earnings this period requires an increase in corporate debt to maintain a constant level of investment. This policy will result in higher current dividends, but lower dividends in the subsequent period in order to repay the principal and interest on this debt. The policy will increase share value if the shareholders value this stream of income at a greater present value than the alternative. If the shareholders' discount rate is greater than the cost of borrowing to the firm, this perturbation increases firm value. King (1977) shows this requires that $(1 - \tau_b) > (1 - \tau_{re})(1 - \tau_c)$. Alternatively this inequality can be interpreted as requiring that the reduction in borrowing costs to a shareholder exceed the after-tax return from reinvesting the earnings in the corporation.

A sufficient condition for debt to be preferred to retained earnings is that the rate of personal taxation is less than the rate of corporate taxation. Debt may also dominate retained earnings when the personal tax rate is greater than the corporate tax rate, provided the tax rate on capital gains is sufficiently high. There would appear to be a range of tax rates over which debt is preferred to retained earnings.

A Tax-Induced Financing Hierarchy?

The results of the analysis in this section have focused only on the effects of taxation on the mix of financing for a firm. The analysis suggests that debt finance and retained earnings are tax-favored relative to new share issues. For a range of tax parameters, debt-finance may be favored relative to

⁶An important implication of this model noted by Auerbach (1979) is that a positive tax rate on dividends does not discourage corporate investment if retained earnings are sufficient to meet investment needs. The dividend tax in this case encourages investment to a point where a unit of new investment is valued at less than a unit by the stock market. Increases in the dividend tax rate could actually lead the firm to undertake greater investment by reducing the opportunity cost of retained earnings.

retained earnings as well.

Mayer (1990) presents a comparison of the extent to which retained earnings, debt and new share issues were used to finance new investment in Canada, Finland, France, Germany, Italy, Japan, the United Kingdom, and the United States between 1970 and 1985. In all countries, despite varying tax treatment, retained earnings were the dominant source of finance, although its importance varied across countries. For example, retained earnings were the source of finance for virtually all net investment in the United Kingdom, while financing just over half of net investment in Italy. Cross country comparisons, however, were unable to find a correlation between the relative tax treatment of each financing source and its use.

In developing countries internal finance is also the primary source of funds for most enterprises. Studies surveyed in Kilby et. al. (1984) note that the original source of funds in rural manufacturing enterprises is predominantly from personal saving or informal loans from relatives. Future expansion is also largely financed from retained earnings. External finance is of limited importance and that which is received is frequently from customers rather than from formal lending institutions.

Recent research has examined differences between investment financed from internal and external sources at the firm level. Auerbach (1984) finds that ex post rates of return are generally higher when financed with new share issues than when financed with retained earnings. The finding supports the idea that each source of financing has a distinct opportunity cost. For example, firms may only resort to new share issues if the projects are sufficiently profitable to cover the higher tax-costs of external finance. Auerbach's finding also suggests that certain firms may be unable to receive debt financing for these projects, since debt would otherwise be preferred to new equity from a tax perspective.

Other research has examined differences in investment behavior across firms experiencing changes in cash flow. A tax-related theory would suggest little effect of cash-flow on investment behavior for firms which are presently paying dividends. For these firms, any investment opportunities could be

financed by reducing dividend payments. For firms not paying dividends, increases in cash flow may give the firm access to tax-favored retained earnings to finance investment. Fazzari, Hubbard, and Petersen (1988a) find that these predictions hold for a large sample of publicly traded firms in the United States, even after controlling for investment opportunities available to the firm using standard neoclassical models.

Fazzari, Hubbard, Petersen believe the strong effect of increases in the availability of internal funds for low-dividend paying firms is greater than would be predicted by taxes only. They argue that these firms are likely to face non-tax constraints limiting the availability of external funds. They suggest that the costs of asymmetric information may preclude these firms from undertaking profitable investment opportunities. The next section of this paper will examine non-tax costs and benefits associated with the use of the alternative sources of finance.

III. Financing Choices under Asymmetric Information

As noted in the conclusion to the last section, the tax-guided view of corporate finance has been unable to explain adequately the observed mix of financing by corporations in different countries. While consistent with the predominant use of retained earnings over new share issues, it may not be a satisfactory explanation for the low use of debt finance. This section will present an alternative theory of finance based on the assumption of asymmetric information. The discussion in this section frequently considers investment to be undertaken by a firm. This is not intended to preclude application of the material to family enterprises, single entrepreneurs, or farmers. Indeed, some of the earliest applications of information asymmetries were to small units of production, such as sharecroppers.⁷ As noted by Hoff and Stiglitz (1990), the problems of asymmetric information may be even more severe in credit markets of developing economies, especially rural areas, where formal legal institutions are especially costly and ineffective and formal information-sharing networks are scarce or nonexistent. Section IV examines specific mechanisms in rural economies established to limit problems of asymmetric information.

Under asymmetric information it is assumed that the managers of the firm have some superior information on the characteristics of the firm's assets and investment opportunities that investors do not have. This information asymmetry can lead to managers undertaking activities that make some of the firm's claimants worse off.

If investors are aware that management may take actions from time to time that make them worse off, they will attempt to contract for this contingency. However to monitor and enforce these restrictions can be very costly. Thus, the problems of asymmetric information can only be partly overcome.

One facet of the literature on asymmetric information has focused on the divergence of interests

⁷See Stiglitz (1974) for an early analysis of the role of information asymmetries in sharecropping. Singh (1989) presents a recent survey on this subject.

of the firm's managers from the shareholders of the firm. In this literature, for example Jensen and Meckling (1976), managers are seen to act in their own interest as employees, rather than as agents for the owners of the firm. The managers may then fail to maximize shareholder value by pursuing goals which augment their own welfare.

Another set of literature has focused on the potential conflicts of the different claimants of the firm, notably shareholders and bondholders. Here, even if the firm's managers act in the interest of the shareholders, actions which would maximize firm value are not generally consistent with those actions which would maximize share value. In a wide set of cases it can be shown that shareholders will favor this deviation from firm value maximization ex post. However, if the firm's debt holders can anticipate deviations from firm value maximization, the shareholders will at least partly bear the cost of this deviation ex ante. Thus, it can be in the shareholders' interest to find mechanisms which successfully limit the possibility for the firm's managers to undertake policies that deviate from firm value maximization. Where the firm is unable to control these deviations ex ante, the firm may find itself borrowing at costs greater than otherwise or it may be denied credit entirely.

A. Bankruptcy as an Inadequate Explanation

One traditional explanation for a limit on the quantity of a firm's investment financed by debt is the increasing probability of default as the firm's debt obligations increase. If operating income is uncertain, the firm is more likely to experience periods in which income is insufficient to service the firm's debt load when the debt is large. However, if changes in the firm's financing mix do not affect the firm's real investments, this increasing risk of bankruptcy will not affect the total value of the firm unless there are costs incurred in the act of bankruptcy, i.e., unless it is costly to transfer assets to the debt holders.

To see this, recall the payoff structure of the debt and equity claims. Let $V(s)$ be the value of the firm in some state of nature s . The value of debt instruments of this firm in state s , V_d , is equal to

$\min[V(s), P]$, where P is the promised payment of interest and principal. The value of equity, V_e , is equal to $\max[0, V(s)-P]$. Note that the sum of the payoffs to debt and equity in all states s is simply $V(s)$. The value of the firm is independent of its division between debt and equity claims. The firm could be entirely debt financed or entirely equity financed and its value would be unchanged. Thus, a simple story of increasing risk of bankruptcy cannot create a limit on debt finance if bankruptcy is costless.

If there are costs incurred in bankruptcy, then ownership of the firm cannot be costlessly transferred to the firm's debt holders. These costs include the direct legal costs and the indirect costs of operating a firm near bankruptcy. Legal costs could be high if it is expected that the firm's shareholders will resist transfer of the firm. A firm near bankruptcy may find increased indirect costs if it is more difficult to receive commitments from suppliers and customers.

The direct costs of bankruptcy, however, have been found to be relatively small. For example, Warner (1977) examined the direct costs of bankruptcy for eleven U.S. railroads between 1930 and 1955. He finds that the average cost of bankruptcy was equal to one percent of the value of the firm, where the firm value is measured seven years prior to bankruptcy. The expected cost of bankruptcy is even less. Thus, bankruptcy costs alone are an inadequate explanation for limits on debt-finance.

B. Asymmetric Information and Bankruptcy Risk

The shortcoming of the pure bankruptcy story is in its failure to incorporate the effects of asymmetric information. Bankruptcy (and more generally limited liability) can alter the shareholders' preference ordering of alternative projects relative to those that would be undertaken to maximize firm value. Here, firm value is taken to be the sum of the value of the equity and debt claims. If the set of projects available to the firm at any point in time is not known to the firm's bondholders, then bondholders will be unable to write contracts that prevent this deviation from firm value maximization. In such a case, the firm may be unable to finance its projects.

One set of deviations from firm value maximization occurs because the value of the shareholders' equity claim is a convex function of the returns on the firm's investments. As a result, the firm's shareholders will prefer riskier investments to safer investments with the same expected yield. The payoff to bondholders is a concave function of the firm's returns. Bondholders prefer less risky investments to riskier investments with the same expected yield. If the risk characteristics of projects available to the firm are not known to lenders, the firm can transfer wealth from bondholders to shareholders by undertaking riskier projects than those contemplated by the firm's lenders. The firm may have this incentive even if the riskier projects have a lower expected return. Further, because the firm is not concerned with the return on its investments in states of bankruptcy, the expected return to shareholders from additional equity-financed investment can be less than the joint return to the firms' bondholders and shareholders. As a result, the firm may fail to undertake investment opportunities that would have been profitable to undertake in the absence of debt.

Both of these factors -- changes in the composition of the riskiness of investment and changes in the level of investment -- can cause firm value to decrease in the presence of debt. Bondholders anticipate that shareholders will undertake all actions that maximize share value, not necessarily firm value. Thus, debt can only be obtained if the expected return to debt holders is sufficient to compensate them for these anticipated actions. This compensation may take the form of higher interest rates. In this case, a firm's shareholders bear the cost of this anticipated deviation.

Higher interest rates, however, may lead the firm to shift to still riskier projects. As shown by Stiglitz and Weiss (1981), in this case an equilibrium can exist where some firms are simply denied credit, while observationally equivalent firms receive credit. The excess demand for credit can persist in equilibrium. Lenders who raise interest rates receive lower returns on their loans because they attract a riskier set of borrowers.

The following sections will examine the consequences of debt finance in the presence of

asymmetric information.

C. Suboptimal Investment in the Presence of Asymmetric Information

A variety of models have been developed to portray the inefficiencies which can occur under asymmetric information with debt finance. These models include Bernanke and Gertler (1990), Calomiris and Hubbard (1990), de Meza and Webb (1987), Leland and Pyle (1977), Myers (1977), and Stiglitz and Weiss (1981). These models conclude that the presence of asymmetric information leads to either over- or under-investment relative to the social optimum. In the absence of asymmetric information, the first-best outcome could be achieved.

In these models, the firm is assumed to have better information on the distribution of returns from a potential project than the firm's lenders. Where lenders cannot distinguish among firms, all firms must pay the same interest rate on their loans in equilibrium. As a result, firms undertaking "better" projects (for example, projects with above average expected rates of return to lenders due to greater probabilities of success), subsidize firms undertaking "worse" projects. Firms with better projects therefore pay a premium relative to the rates they would pay if lenders were privy to the information known to the firm. Firms with better projects that are able to raise capital from internal funds to undertake the investment are then able to capture the full benefit of their projects.

Thus, asymmetric information can cause a divergence between the yield required on a project funded from internal sources versus that required on a project funded externally. A firm may be considered finance constrained if internal funds are exhausted before the firm has been unable to undertake all projects with yields in excess of the firm's opportunity cost of capital, yet the projects' yields are insufficient to cover the cost of external funds. Alternatively, the information asymmetry may lead to credit rationing. Funds may be denied to the firm despite the firm's willingness to pay the market rate of interest. In either case, a marginal change in the quantity of internal funds available for investment can have a positive effect on investment, while a marginal change in the cost of obtaining

external funds might have no effect. Traditional analyses of the effects of taxation on investment behavior, such as the Hall-Jorgenson (1967) cost of capital model, focus on the effect of a tax change on the required marginal return of capital, assuming the source of funds is perfectly elastic. As indicated by Fazzari, Hubbard, and Petersen (1988b), however, changes in the average profitability of capital may be more important for finance constrained firms.

In this section, the effects of asymmetric information on the investment undertaken by a firm in the presence of debt finance are presented using models representing two different types of financing decisions for the firm. While these two models cannot fully portray the full range of effects of asymmetric information on the financial and investment decisions of a firm, conclusions drawn from these models are representative of those based on more specialized models in the literature.

The first model is based on de Meza and Webb (1987).⁸ In this model, a firm is seeking to borrow funds for a project with an uncertain probability of success. The second model is based on Myers (1977).⁹ A firm in this model uses both debt and equity. The firm has future projects which it may seek to undertake at a later date by issuing additional equity. These models encompass a wide variety of potential investment decisions of firms.

1. Over-Investment or Under-Investment with Asymmetric Information

A common model to demonstrate the effects of asymmetric information on investment is to assume that the population consists of a set of entrepreneurs, each with access to a unique risky project. The project of entrepreneur i is assumed to have two possible outcomes: success, in which case the project's return is R_i^S ; or failure, in which case the project's return is R_i^F . The probability of success is p_i . A project requires total investment k . Each entrepreneur has the same wealth w , which is less than

⁸ With modifications, this model can also be used to analyze the findings of Stiglitz and Weiss (1981), Bernanke and Gertler (1990), and Calomiris and Hubbard (1990).

⁹ This model has been modified by Long and Malitz (1985).

k. It is assumed that lenders know the joint distributions of project returns and success probabilities, but cannot distinguish among entrepreneurs. As a result, all entrepreneurs who receive loans borrow at the same interest rate r . Entrepreneurs are assumed to know more about their own risk characteristics than lenders, creating a problem of asymmetric information.

The heterogeneity of investors is simplified by assuming either (a) the probability of success p_i is the same for all entrepreneurs but project returns R_i^s and R_i^f vary across entrepreneurs, or (b) the probability of success differs across entrepreneurs but project returns are identical. Let us first examine the model under this latter assumption, as assumed by de Meza and Webb (1987) and Bernanke and Gertler (1990). We will later examine an alternative assumption and see that the results of the model change as shown by de Meza and Webb.

Assume that all entrepreneurs have identical wealth and identical project sizes. An entrepreneur borrows $B = k - w$ from lenders if the project is undertaken. It is assumed that $R^s > (1+r)B > R^f \geq 0$. If the project fails, the entrepreneur defaults on the loan. Entrepreneurs are assumed to know their probabilities of success and are risk-neutral.

An entrepreneur undertakes his or her project provided the expected return from the project exceeds the opportunity cost. The opportunity cost is assumed to be the safe rate of interest ρ offered by a bank on its savings accounts in which the entrepreneur could have saved wealth w . An entrepreneur i then undertakes his or her project provided

$$(1.1) \quad p_i(R^s - (1+r)B) \geq (1 + \rho)w.$$

The marginal project undertaken, that is, the entrepreneur for which equation (1.1) holds with equality, has the lowest probability of success of those projects undertaken. Let us denote this probability by p^* , so

$$(1.1') \quad p^*(R^s - (1+r)B) = (1 + \rho)w.$$

The profits to a competitive banking industry from lending to all entrepreneurs must be zero in

equilibrium. If the banking industry earns profits on projects with high probabilities of success, it must lose profits on loans to projects with the lowest success probabilities. Thus the return to the bank on the marginal project with success probability p' is less than the cost of funds to the bank,

$$(1.2) \quad p'(1+r)B + (1-p')R^f < (1 + \rho)B.$$

Finally, the socially optimal level of investment is to undertake all investment for which the expected return exceeds the opportunity cost, or

$$(1.3) \quad p_i R^s + (1-p_i)R^f \geq (1 + \rho)k.$$

Note that for the marginal project with success probability p' , adding equations (1.1') and (1.2) (and noting that $w+B=k$) shows that the expected return from this project is less than its opportunity cost,

$$(1.3') \quad p'R^s + (1-p')R^f < (1 + \rho)k.$$

In this model, asymmetric information leads to over-investment relative to the social optimum. Poor investments, that is, investments with an expected return less than the economy-wide opportunity cost of capital, are undertaken because the entrepreneur is not concerned with the return on the project in states of default. Banks lose profits on loans to low-probability-of-success entrepreneurs. These losses are just offset by the profits earned on high-probability-of-success entrepreneurs. Note that a bank in a competitive market cannot make greater profits by either rationing loans or by charging a different interest rate than the competitive rate on loans. There is no advantage to rationing since the expected profitability on each loan is zero. It cannot charge a higher rate than other banks charge either. If it charges a lower rate, it attracts all current entrepreneurs and new entrepreneurs with even lower probabilities of success.

Entrepreneurs with high probabilities of success pay higher interest rates than they would if their success probabilities were known to lenders. Because they are unable to identify themselves to banks, they end up subsidizing the low-probability-of-success entrepreneurs. It is worth noting the effects of

changes in the wealth of entrepreneurs on the equilibrium level of investment. A marginal increase in the wealth of a high-probability-of-success entrepreneur would allow the entrepreneur to increase the expected profit from undertaking the project.¹⁰ This entrepreneur would reduce borrowing. On the other hand, a marginal increase in the wealth of an entrepreneur with success probability p' (from equation 1.1') would cause this entrepreneur to now reject the project. If the wealth of each entrepreneur were greater than the project size, the optimal level of investment would always be undertaken. Bernanke and Gertler (1990) and Calomiris and Hubbard (1990) further analyze the effects of changes in the level and distribution of wealth in an economy. Entrepreneurs in developing economies, faced with a low level of personal wealth, may be able to undertake projects of only limited size given their inability to raise sufficient collateral.

It is important to note, however, that no project with expected returns greater than the opportunity cost of capital is denied funds in the model presented above. de Meza and Webb (1987) show that this result is dependent on the assumption that all projects have the same return R^S if successful. If, alternatively, it is assumed that all projects have the same expected return, but both the probability of success p_i and the return if successful R_i^S vary, then entrepreneurs may be credit rationed. This replicates the finding of Stiglitz and Weiss (1981) that projects with expected returns greater than the opportunity cost of capital may go unfunded. The proportion of successful and unsuccessful entrepreneurs in the population who receive loans is the same as in the population of entrepreneurs denied loans.

In this modified model, the entrepreneur who is indifferent between undertaking the project and receiving the safe return ρ on his or her wealth has the highest probability of success. (See Appendix

¹⁰The entrepreneur's expected profit from undertaking the project relative to his opportunity cost is (from equation 1.1) $p_i(R^S - (1+r)B) - (1 + \rho)w$. Differentiating with respect to w yields, $p_i(1+r)dw - (1 + \rho)dw$, where use of the identity $B=k-w$ has been made. Let us assume here that $R^f=0$. Since the banking sector in equilibrium makes zero profit, $\rho=r\bar{p}$, where \bar{p} is the average probability of success. Thus, entrepreneurs with $p_i > \bar{p}$ have an increase in expected profit, while those with $p_i < \bar{p}$ have a decrease in expected profit.

B for an explanation of this outcome.) As a result, increases in the lending rate r cause the entrepreneurs with the highest probability of success not to undertake their projects. This increases the riskiness of the projects funded by the bank. If the increased riskiness of these projects reduces profits to the bank by more than the increase in profits from the higher rate paid by successful projects, an equilibrium with rationing results. Here, too little investment is undertaken when entrepreneurs require loans to undertake their projects. Table 1 summarizes the different outcomes of these two models.

Table 1
Asymmetric Information with Debt Finance

Type of uncertainty in model	Outcome
Uncertain probability of success (de Meza-Webb, 1987)	Over-investment
Uncertain payoff if successful (Stiglitz-Weiss, 1981)	Under-investment

As in the earlier model presented, the entrepreneurs with high-probability-of-success projects subsidize entrepreneurs with lower probabilities of success. Because lenders are unable to distinguish among entrepreneurs, entrepreneurs with "better" projects are affected by credit rationing along with the entrepreneurs with "worse" projects. Although in the presentation of this model it was assumed that the expected returns to all projects are the same, it is possible that projects with the highest probabilities of success also have the higher expected rates of return. In this case, asymmetric information results in some poorer projects receiving funding while better projects go unfunded. While asymmetric information can result in either over- or under-investment in these models, the models concur in the finding that there can be a divergence between the required return on internally generated funds and that required if external

funds are sought.

2. Myers' (1977) Model of Debt and Under-Investment

Myers (1977) demonstrates how a partly debt-financed firm may undertake less than the optimal amount of investment in the presence of asymmetric information. In this model, firm value is composed of the value of existing assets and future growth opportunities. The growth opportunities require a future investment, and the returns from the future investment depend on the state of nature. The state of nature is revealed to the firm before the subsequent investment is made. The value today of these growth opportunities is the present value of the returns from these opportunities less the cost of undertaking the investment in those states of nature where the investment is undertaken. Myers shows that growth opportunities which would be undertaken by an unleveraged firm in some states of nature will not be undertaken by the leveraged firm. Thus, the net present value of the growth opportunities is less in the leveraged firm. If bondholders can correctly anticipate the states of nature in which the firm will fail to exercise the growth option, then there can be no transfer of wealth from bondholders to shareholders. In this case, the loss in firm value is borne by the shareholders.

Consider an unlevered firm with no existing assets in period zero which is valued for a single growth opportunity which can be exercised at the beginning of period one. The growth opportunity will require equity-financed investment at that time of I , and yield returns of $V(s)$ in state s . Let the states of nature be ordered in increasing profitability of the investment opportunity. The growth option will be exercised then for all $s \geq s_a$, where s_a is the state of nature such that $V(s_a) = I$. The value of the firm in period zero if investors are risk-neutral can then be written as

$$(2.1) \quad V = E\{\beta \cdot [V(s) - I \mid s \geq s_a]\} \cdot \Pr(s \geq s_a),$$

where β is the one-period discount rate, and $\Pr(\cdot)$ denotes the probability of the event.

Now consider the effect on firm value if the firm issues debt to repurchase shares of initial equity owners before the state of nature is revealed to the firm. The firm value is unaffected by the issuance

of debt in period zero if the debt holders are free to undertake the investment opportunity in the event that the shareholders default. The value of the firm's remaining equity after the debt is issued is

$$(2.2) \quad V_e = E\{\beta \cdot [V(s) - I - P \mid s \geq s_b]\} \cdot \Pr(s \geq s_b),$$

where P is the payment of interest and principal, s_b is the state of nature such that $V(s_b) = I + P$, $s_b > s_a$. The shareholders choose to exercise the growth opportunity requiring equity contribution I only if it is sufficiently profitable to cover the cost of investment and the debt service.

The value of the firm's debt is

$$(2.3) \quad V_d = E\{\beta \cdot \min[P, V(s) - I \mid s \geq s_a]\} \cdot \Pr(s \geq s_a).$$

If the shareholders default ($s < s_b$) and $s \geq s_a$, the debt holders find it worthwhile to invest the quantity I required to carry out the project. If P is considered the face value of the firm's bonds, then the bonds are issued at a discount from face value of $1 - (V_d/P)$.

Note that in this case the sum of the value of the debt and equity claims given by equations (2.2) and (2.3) is equal to the value of the unlevered firm shown in equation (2.1). Here debt does not reduce the value of the firm. The wealth of the initial equity owners is equal to V in both cases. Where debt is issued, the equity owners receive an immediate payment of V_d and have remaining equity equal to V_e . The wealth of the initial equity owners is the same in either case.

If, however, the investment opportunity is assumed to vanish if not undertaken by the firm's owners, then the value of the firm is dependent on the amount of debt borrowed. Consider the value to debt holders of bonds promising the same uncertain payment P next period under this alternative assumption. Bondholders know this payment will only be received if $s \geq s_b$. Further, if $s_b > s \geq s_a$, the bondholders receive nothing, since they are unable to exercise the growth option. The value of the firm's debt, V'_d , in this case is

$$(2.4) \quad V'_d = E\{\beta \cdot [P \mid s \geq s_b]\} \cdot \Pr(s \geq s_b).$$

Note that V'_d is strictly less than V_d given by equation (2.3). However, the value of the

remaining equity V'_e is the same as given by equation (2.2). Thus, the value of the levered firm $V' = V'_d + V'_e$ is less than the value of the unlevered firm. The wealth of the initial equity owners, equal to their receipt of V'_d in cash and their remaining equity share V'_e , is reduced by the issuance of debt.

Myers (1977) suggests that for many firms the value of future growth opportunities may constitute an important part of firm value. Additionally, the value of existing assets can be dependent on future discretionary spending by the firm on activities such as maintenance and advertising. To the extent that the proper level of these expenditures is known in advance, a contract could be written requiring these investments in amounts depending on the state of nature. However, it is unlikely that the state of nature could be revealed sufficiently to outsiders to allow for proper legal enforcement of the contract. The alternative is to require a minimum level of investment independent of the state of nature. This would avoid the problem of asymmetric information for these investments for states of nature $s \geq s_a$, but result in over-investment for $s < s_a$. The over-investment in these activities in poor states of nature reduces the value of the growth options. Again, it is the equity holders who bear this loss.

Further, for many activities the presence of an investment opportunity may be unknown to outsiders. Consider for example a firm's research and development (R&D) program. The R&D program may be expected to generate numerous growth opportunities, although the exact number and characteristics of the projects may be difficult to ascertain in advance. As a result, discoveries which are known to lead to small, but positive, net present values may not be carried out by the firm's managers. Bondholders could not contract for these discoveries to be carried out, because by their very nature they are not known in advance. Even if, upon default, the bondholders did learn of the existence of a discovery, management could argue that the project was not expected to yield a positive present value.

Although the example presented above is based on a firm with no existing assets and only growth opportunities, the conclusions of the model apply to firms with existing assets and growth opportunities, provided there is some risk of bankruptcy. Because the levered firm will follow through on less of its

profitable growth opportunities, the equity holders in a levered firm will value these opportunities at a reduced value relative to the equity owners of an unlevered firm. A firm will then ordinarily prefer to not issue risky debt, if it wishes to take advantage of potential future growth options. The firm will use internal funds first to finance its investments, and only if these are insufficient consider financing with debt. Any debt-financed investment must have a sufficiently high net present value that it increases share value by more than the loss in value resulting from the decline in value of the growth opportunities. Himmelberg and Petersen (1990) present empirical evidence that R&D investments are sensitive to the availability of internal funds, confirming the hypothesis that firms can only raise outside funds for this purpose at a higher cost.

The Myers model of asymmetric information, though formulated differently than the model presented in the previous section, leads to a similar conclusion that the cost to the firm of using external funds is likely to exceed the cost of internal funds. If the firm's internal resources are low, it may be unable to undertake all investments that it would at a higher level of profitability. The divergence between the cost of internal and external funds may result in projects with positive net present values going unfunded. IV. Rural Credit Market Solutions to Asymmetric Information

Increasing attention has been given to the problems of informational asymmetries in financing projects in the rural sectors of developing countries. Informational problems in these sectors are severe. The mechanisms created to limit the impact of informational asymmetries offer interesting insights on means of overcoming these problems.

Informational asymmetries arise in a rural context in part because borrowers (largely farmers) differ in their productivity and the productivity of their land. Lenders therefore have a problem of trying to ascertain the risk and possible collateral of different borrowers. Those with excellent collateral may be most able to receive loans from the formal sector (Floro and Yotopolous, 1991, Aleem, 1990). Poorer borrowers may only receive loans from the informal sector. Even where collateral might exist, poorly

defined legal rights in property and high enforcement costs may preclude borrowing from the formal sector.

Aleem (1990) presents some evidence on the extent of imperfect information in these markets. He finds that lenders in the informal sector spend an average of one day to screen loan applicants. After this screening, an average of 50 percent of the applicants are rejected. Administrative costs associated with these loans were estimated to represent 40 to 50 percent of the principal borrowed. Thus, to a large extent, lenders in the informal sector are only able to overcome the disadvantage of asymmetric information by incurring significant costs to gain information on their borrowers. Other practices or mechanisms are intended to directly reduce the costs of informational asymmetries. Two such mechanisms are discussed in the remainder of this section.¹¹

Interlinkage between credit and other markets. One manner by which lenders minimize these informational costs is by lending only to those who have an additional relationship with the supplier of credit, such as a customer or a supplier of inputs. These interlinkages are intended to reduce the costs of obtaining information, monitoring behavior, or enforcing repayment. Bell (1989) notes how interlinkages can increase the ability of lenders to shape the behavior of borrowers without adversely affecting risk. Consider for example a loan to a supplier of inputs. Aleem notes in his examination of rural credit markets in Pakistan, "In general, at least one end of the loan transaction involved the delivery of commodities, with the loan either extended or repaid in kind."¹²

Requiring a farmer's crop as repayment has several features which minimize the problems of informational asymmetries. First, the lender is given a means of measuring the productivity of the

¹¹For further discussion of these and other mechanisms, see the overview paper by Hoff and Stiglitz (1990).

¹²Aleem notes that the high occurrence of loans repaid or lent in kind in Pakistan may also be a way of avoiding loans bearing fixed interest rates, which would be considered un-Islamic. This interlinkage, however, is also found in other non-Islamic developing countries (see Siamwalla et al., 1990).

borrower when considering loans in future growing seasons. This feature encourages the borrower to appear as productive as possible.

Second, the crop represents a form of collateral which can be collected by the lender at harvest time. For crops without fixed harvest periods, Siamwalla et al. (1990) note that the land and standing crop may be transferred to the lender for a fixed period of time.

Finally, purchase of the farmer's output ensures that the lender and not other borrowers has access to information on the continuing productivity of the borrower. By limiting knowledge of the borrower's characteristics to other potential lenders, the lender may be more able to enforce repayment with the sanction of denial of credit in the event of default. Where a borrower can quickly start anew with a new lender, this sanction has no effect. However, where credit is only extended after establishing a lengthy relationship, default and the subsequent denial of credit may be an important incentive.

The practice of providing the initial loan in kind, for example, with seed or other inputs rather than currency, also may reduce the costs of information asymmetries. This practice gives the lender greater control over the use of the loan proceeds for the stated purpose and knowledge of the production technique to be used.

Trade networks may result in credit being extended from one level to another through a series of trading relationships (Floro and Yotopolous, 1991). Intermediate firms in these relationships may not be net creditors, but conduits through which credit flows to lower levels. This layering of credit makes use of personalized trading relationships between parties that reduce the riskiness of the loans. One disadvantage to the layering of credit is that transaction costs are incurred at each level, even though no net credit may occur at that particular level.

Interlinking can have ambiguous welfare consequences. Since a prior trading relationship may be necessary before a borrower can receive a loan, conditioning a loan on the requirement of an exclusive trading arrangement with the lender gives the lender a monopoly power. This allows the lender to charge

a higher effective rate of interest than might occur with competitive markets.

The practice of interlinking is not unique to rural credit markets. Trade credit is common in developed and developing countries. Producers of capital goods frequently provide financing for purchasing or renting these goods. Another type of interlinking is through a franchise, under which credit may be extended in return for an exclusive relationship with the parent firm.

Peer monitoring. Siamwalla et al. (1990) and Stiglitz (1990) discuss a mechanism under which a loan is received by individuals who form a group. Each member of the group is jointly liable for the debts of the other members of the group. As Stiglitz notes, the advantage of such a system is that the members of the group are better able to monitor the use of funds by an individual borrower than the lender. This monitoring can ensure that a farmer does not use risky methods (or methods riskier than that which other members of the group can tolerate) and does not shirk. Pressure can be applied by the fellow debtors on a non-compliant borrower. Further, because borrowers of similar risk have an incentive to pool together, the risk characteristics of the group may be easier to ascertain by the lender than the characteristics of any particular individual.

Peer monitoring can also lead to more efficient production decisions. Consider for example the Myers (1977) model discussed in the last section where a debt-financed firm may in future periods undertake suboptimal levels of investment. An example in a rural context in the absence of peer monitoring may be the following: A farmer receives a loan to finance the planting of a crop. As the crop develops, insect damage ravages the crop. This state of nature -- insect damage -- is unobservable to the lender, but not to the farmer. An application of pesticide might be cost effective, but perhaps not save a sufficient amount of the crop to prevent default on the loan. In this case, it is not in the farmer's interest to apply the pesticide. This is inefficient if the cost of the pesticide is less than the value of the crops that could be saved through its application.

One way to prevent this inefficient behavior is to mandate application of pesticides at all times,

regardless of whether it is necessary. Indeed, as noted by Thrup (1990), agricultural loans in developing countries often require application of pesticides whether they are necessary or not. This, too, is inefficient since expenditures on pesticides are wasted when crop damage from insects is minimal.

The peer monitoring group may be an alternative solution. Consider when a single farmer's crop could benefit from application of pesticide, even though the yield from the crop will be insufficient to prevent default on the farmer's loan. The group, since it is jointly liable for the farmer's loan, would have the appropriate incentive to apply the pesticide when it is cost effective. The additional expenditure on the pesticide would reduce the group's liability when the loan of the individual farmer is defaulted upon. Only at high monitoring costs could a lender achieve the same outcome as the peer monitoring group.

The peer monitoring group may be able to prevent this sort of inefficiency only when the state of nature requiring subsequent investment is not strongly correlated across all members of the group. For example, if all farmers simultaneously experienced insect damage, it might be in the interest of the group not to apply pesticide and jointly default on the loan. This general lack of risk diversification are disadvantages of the peer monitoring system. There is a tradeoff between peer group members being located in the same area so as to maximize their ability to monitor and assist each other versus the increased sensitivity of all members to common risks, such as environmental conditions. Stiglitz (1990) also notes that as the size of a peer monitoring group expands, free-rider effects may reduce individual incentives to monitor the other members of the group. This disadvantage must be weighed against the benefits of risk diversification from expanding group size.

Experience with one peer monitoring group, the Grameen Bank in Bangladesh, has been quite successful. Loans through this program have experienced a default rate of only three percent (Biggs et. al., 1991). Braverman and Guasch (1989) note, however, that other types of cooperative credit programs have been less successful. They find these failed programs are characterized by lack of joint

responsibility and sense of belonging within the group, dishonesty, and poor administration and coordination both within the group and with the lending institution. These failures underscore the importance of carefully designing the structure and incentives within a cooperative credit group.

V. Policy Implications

This paper has identified effects of taxes and asymmetric information on financing choices. The classical corporate tax system is likely to create a lower opportunity cost on the use of retained earnings by the firm than new share issues. Asymmetric information may also create a financing hierarchy within the firm by which retained earnings are available at a lower cost to the firm than external financing. The previous sections discussed several ways in which the cost of obtaining debt finance could exceed the required return on additional internal financing.

These factors suggest that where firms do not all have equal access to retained earnings, investment is unlikely to be undertaken in a manner which maximizes the return to the economy from its level of savings.

The important question facing policy makers is whether there are instruments available to the government that are not available to the financial markets which could reduce the costs of asymmetric information. This section of the paper will examine possible government policies which could mitigate the effects of asymmetric information on investment. The policies to be examined can be grouped into (a) policies which promote equities markets, (b) regulation of the banking sector, (c) specific tax instruments, and (d) other measures.

A. Promotion of Equity Markets

Equity financing of investment represents one alternative to debt finance. In the absence of taxation and asymmetric information, risk neutral agents would be indifferent to these sources of finance. A classical corporate tax system, by allowing a deduction for interest paid but not for dividends, creates one wedge favoring debt finance. We wish to examine here whether, in the absence of this tax disadvantage, private markets would favor the use of equity financing of investment over debt. That is, are the costs of asymmetric information less with equity finance than with debt finance?

Problems of asymmetric information are different, but still exist with equity finance. The

inability of outside equity owners to monitor perfectly the effort of the firm's owner-manager may result in too little effort being provided by the manager (Jensen and Meckling, 1976). In activities where managerial effort is an important determinant to the success of the firm and not easily monitored, the costs of asymmetric information with equity contracts may be large.

Myers and Majluf (1984) note other costs that arise with equity finance when additional funds are required. Managers of the firm have better information on the value of the firm's existing assets and growth opportunities than outsiders. If managers seek to maximize the wealth of existing shareholders, they will prefer to issue new equity when the firm is overvalued. Outsiders, knowing this, discount the amount they are willing to pay for the shares. Truly good projects then must pay a premium to new investors because they cannot be distinguished from shares being issued by overvalued firms.

In both the Jensen and Meckling and Myers and Majluf models, if a firm could borrow with riskless debt the problem of asymmetric information would be overcome. In both cases a firm would use debt finance to undertake all projects with positive net present value. Whether the costs of issuing risky debt are less than the costs of issuing new equity is unclear. Myers (1984) suggests that a firm can minimize the riskiness of its debt by keeping debt burdens low. This allows the firm an option to issue debt at low costs if it is in need of financing a very profitable project. A firm will forsake some positive net present value projects in order to leave this funding option open. Stiglitz and Weiss (1983) see a tradeoff between issuing risky debt and equity depending on the degree that the returns of the firm are dependent on managerial effort and the scope the firm has to undertake projects with different degrees of risk. Where the former is dominant, debt is the optimal instrument. Where the latter is dominant, equity is the optimal instrument. In between, mixtures of debt and equity may minimize the costs of asymmetric information.

There is probably a role for both debt and equity securities. It is unlikely that government encouragement of an equities market could increase costs of information asymmetries. Parties could

always choose not to use instruments for which transaction costs, including the costs of asymmetric information, are high. de Meza and Webb (1987) point out that the inefficiencies of debt finance found in the model of Stiglitz and Weiss (1981) which does not incorporate moral hazard, would not exist with an equity contract. Certainly, government regulations should not restrict the range of contingencies over which parties contract.

A well-functioning equities market may initially require substantial investment in providing an institutional infrastructure. An efficient legal system to enforce contracts and to prosecute fraud is one such investment. Uniform accounting standards are necessary to value securities in an unbiased manner. Even in markets with highly developed financial and legal institutions, price volatility and outright fraud may exist.

Hybrid securities, or mixtures of debt and equity contracts may also serve to reduce costs of asymmetric information. Tax rules may hinder the development of equity-like securities. For example, debt instruments with payment streams contingent on the level of earnings may be treated as equity, causing the firm to lose its deduction for these payments.

While equity securities have some incentive advantages, there are other reasons for believing that financial institutions such as banks may be more successful at resolving problems of information asymmetries than decentralized securities markets. Mishkin (1990) and others have noted the advantages available to banks as lending institutions: information collection costs may decline with the scale of lending; a single lender is not subject to the free-rider problem of discovering the credit worthiness of a borrower that may be present in decentralized securities markets; and costs of monitoring are not duplicated.

Additionally, as noted by Stiglitz and Weiss (1983), banks are free to engage in multi-period contracts with a borrower. A multi-period contract making the issuance of further loans subject to satisfactory payment of earlier loans gives the lender more degrees of freedom in structuring incentives

for the borrower. One criticism of the variety of models presented in section II' is their focus on a single investment, whereas "financial relations are not a one-shot affair" (Hellwig, 1989). While multi-period contracts may improve borrower/lender contracts relative to open securities markets, the long-term credit reputation of a firm is a form of intangible capital which can enhance a firm's ability to borrow at reduced cost in open securities markets as well.

Alternative means of reducing informational asymmetries include conglomerate mergers and industrial groups like the Japanese keiretsu. Industrial groups have been recognized as alternatives to traditional financial institutions (e.g., Leff 1976). Recent research on the Japanese keiretsu has confirmed their ability to reduce the effects of credit rationing (Hoshi, et. al. 1990a, 1990b). It should be noted, however, that where only some firms have access to group financing, the overall allocation of capital may not necessarily be improved. Firms within industrial groups may undertake investment with low marginal returns, while firms outside industrial groups are unable to undertake projects with higher returns.

B. Regulation of the Banking Sector

The banking sector is frequently subject to a variety of regulations. As mentioned above, regulations restricting the contingencies over which borrowers and lenders may contract can limit the ability of lenders to modify the incentives of borrowers. One example of such a restriction is an inability for banks to take an equity position in their borrowers.

Other specific changes in regulations may be highly dependent on the form of the informational asymmetry. For example, in section III it was shown that there can be over-investment with competitive lending markets. Perhaps surprisingly, regulations limiting competitiveness of the banking sector can lead to more efficient allocation of investment funds. For example, a monopolist lender would never reduce lending rates to the point where the return on the marginal borrower was negative. Lending rate floors as opposed to usury laws could increase efficiency here by limiting borrowing. The quantity of loanable funds could also be limited through ceilings on the rates which could be paid by banks.

Where the informational asymmetry causes under-investment, policies restricting competition would only further reduce investment. Deposit insurance, which can encourage risk-taking by banks, may result in excessive risk-taking as demonstrated in the U.S. in the 1980s. In the model presented in section III leading to credit rationing, deposit insurance would not improve the allocation of investment funds.

Competition may also limit the ability of a bank to engage in certain multi-period contracts. For example, part of a bank's ability to enforce repayment of debt may be the sanction of denying future credit. Alternatively, in return for favorable treatment toward a borrower in the present period, the bank may increase the borrower's costs for subsequent loans. In a competitive loan market, the borrower may be able to avoid these costs or the sanction of credit denial by borrowing from a competing bank for the subsequent loan (Mayer 1988).

C. Tax Instruments

Section II of this paper identified how the differing tax treatment of equity and debt can create divergent costs in the use of retained earnings, new share issues, and debt finance. In this section, the emphasis is on how specific tax instruments can improve the allocation of finance in the presence of asymmetric information.

Unfortunately, the use of tax instruments appears to be highly dependent on the nature of the information asymmetry. In the model presented in section III where there is over-investment, de Meza and Webb (1987) show how a tax on interest paid on savings can lead to the first-best outcome. In a similar model, Bernanke and Gertler (1990) find that a tax on the return to successful projects reduces over-investment. Both papers note how this result is sensitive to the specification of the information asymmetry. In the model of Stiglitz and Weiss (1981) leading to rationing, de Meza and Webb show that an interest rate subsidy on savings is necessary to achieve optimality. Cho (1986) suggests that a tax paid on successful projects to compensate banks for losses incurred by banks on additional loans beyond a

rationing equilibrium may increase efficiency.

There may be systematic characteristics of the information asymmetries associated with certain projects as opposed to certain entrepreneurs. In this case it may be easier to identify types of projects which should receive favored tax-treatment, rather than types of entrepreneurs. For example, Myers (1977) and Long and Malitz (1985) suggest that firms with significant intangible investments, such as R&D, may be less likely to support debt finance than firms with tangible assets. This is a result of the Myers model, where growth opportunities are less likely to be undertaken in the presence of debt finance. Debt finance can only be obtained in this model if lenders can anticipate the extent of the future under-investment. Because future intangible investments are more discretionary and less easily monitored by lenders than maintenance of tangible assets, firms with intangible investments may be unable to obtain debt finance. Long and Malitz also note how the moral hazard problem of debt finance is greater with intangible investments. Firms have a greater ability to shift the direction of intangible investment toward riskier projects than tangible investments, the use of which is more easily monitored. This may argue for more favorable tax treatment of intangible investments. Favorable tax treatment of R&D is frequently argued on the grounds that the social returns to this activity exceed the private returns. The information asymmetry argument suggests there may be under-investment in this activity even in the absence of any divergence between social and private returns.

A number of other tax instruments, such as special tax rates for capital gains could also be considered. In some cases, it may be desirable to tax investment gains and losses of lenders on an accrual basis rather than upon realization. For example, where a bank suffers losses on its loan portfolio, it may have an incentive to sell this portfolio to realize the tax losses. (Accounting rules may on the other hand give banks an incentive not to realize the loss.) If there are certain efficiencies from a continuing borrower/lender relationship, however, it would be more efficient for the bank to be able to receive the tax loss without requiring sale of the loan portfolio. Such a system is designated mark-to-

market, since the tax value of the securities are their current market value. The cost to the government of this favorable treatment of tax losses could be compensated for by marking-to-market all loans of the bank, not just those that have declined in value. The difficulty in such a proposal is that except for widely traded securities market valuation is difficult to ascertain.

One role government can play in the presence of a poorly functioning equity market is to become an equity partner. One way in which it can do this is to allow the immediate write-off or expensing of new investment. This reduces the cost of an investment I to $(1 - \tau)I$, where τ is the tax rate of the entrepreneur. Where wealth of the entrepreneur is a limiting factor, this can increase investment. Where equity is an inefficient instrument, for example because the effort of the entrepreneur is variable, this inefficiency will also be present with the government as an equity partner. Additionally, the ability of the government to perform as a pure equity partner may be limited by imperfect loss offsets, minimum tax schedules, and progressive taxes.

D. Other Measures

Bernanke and Gertler (1990) note the important effects of entrepreneurs' endowments on the efficiency of investment. They suggest that wealth redistribution by the government from entrepreneurs with low-expected return projects to entrepreneurs with high-expected return projects can improve efficiency. The effects of marginal changes in wealth on projects with different probabilities of success was examined in section III. Such policies would likely conflict with notions of horizontal and vertical equity. Bernanke and Gertler suggest such wealth transfers may take the form of debtor bailouts, if such entrepreneurs are believed to have good expected returns on investments. They note, however, the probable moral hazard problems of entrepreneurs taking even riskier projects if they know they will be bailed out in the event of failure.

It is not clear whether the government is better able to identify credit worthy recipients than financial markets. Tybout (1983) notes the failure of government credit schemes to allocate scarce

financing to its most efficient use. Tybout finds the marginal return on projects by firms rationed from credit to have a higher return than firms favored under government credit schemes. Tybout notes that rent-seeking activities to receive favored government treatment can further decrease efficiency. It should be noted that government provision of credit is not limited to countries without well-functioning financial institutions. One-third of all credit extended in the U.S. in the 1980s has been subsidized by the federal government (Gale, 1991).

Stiglitz (1990) notes direct government intervention in credit markets may be unlikely to be successful:

If informational problems are the barrier to the development of an effective capital market, then there is no reason to presume that governmental lending agencies will be in a superior position to address these problems. Indeed, the lack of incentives for government bureaucrats to monitor loans may exacerbate the problem.¹³

Further, the political system may lack the willpower to enforce the collection of government debts, turning government loans effectively into government grants.

Instead, Stiglitz suggests that more basic government efforts in establishment of an infrastructure - both physical and legal -- may do more toward reducing credit risks. Physical improvement of transportation networks and irrigation can directly reduce the risks faced by agrarian economies. The establishment of a legal infrastructure would provide the legal means to enforce credit contracts.

Policies which increased the accessibility of collateral to borrowers may also be warranted. For example, land titling in rural areas might allow the use of land as collateral. This type of policy could reduce information costs of borrowing without the consequent distributional effects of policies such as those suggested by Bernanke and Gertler. In this regard, policies which lead to the accumulation of wealth also lower costs of asymmetric information. Further, lending institutions which also serve as

¹³Joseph E. Stiglitz, "Peer Monitoring and Credit Markets," The World Bank Economic Review vol. 4 no. 3 (September 1990), p. 362.

savings institutions may be able to develop better information regarding the credit worthiness of their borrowers through this linkage and better enforce repayment of loans.

Lenders that also have trading relationships with their borrowers may have a greater ability to minimize costs of asymmetric information. Policies that promote the dissemination of credit through trade networks may be effective. Multinational corporations could be given incentives to make credit accessible to customers and suppliers. Efforts should encourage the transmission of credit from each level in these trade networks.

In the past many aspects of credit programs in developing countries have been criticized as being overly rigid and not taking local conditions into consideration. For example, Kilby et. al. (1984, p. 279) state: "Constraints placed on the use of rural credit should be removed so that rural households can more easily allocate their financial resources toward uses where they perceive the highest return." In a similar vein, Thrup (1990) criticizes the mandated use of certain technical factors, such as fertilizers or pesticides. It is true that these restrictions are likely to result in suboptimal use of resources. But these authors frequently fail to point out that these restrictions are in part necessitated because the borrowers and lenders do not share equally in risk and returns. The structure of the debt contract is likely to induce riskier projects than would otherwise be undertaken. Some restrictions on activities may be the only way that lenders can mitigate this tendency. Before criticizing credit programs as overly restrictive one must determine whether there are alternative means to overcoming the problems of asymmetric information.

Given the variety of different problems caused by asymmetric information, it would be surprising if there were a single solution to these problems. Tradeoffs between alternative policies abound. The optimal form of finance for some activities may be debt while for others it is equity, depending on the importance of effort by the entrepreneur and the risks of alternative techniques of production. Restrictions on the range of techniques that may be used by a borrower reduce the risk to the lender, but may result in inappropriate technology being used. Peer monitoring groups offer one method of reducing

monitoring costs, but they may also transfer risk to borrowers who might be more risk-averse than their lenders. The composition of peer monitoring groups affects risk diversification and incentives to monitor other group members. The variety of tradeoffs suggests that experimentation with different approaches to controlling the costs of asymmetric information may be productive.

Appendix A. Modigliani-Miller Homemade Leverage and Firm Value

Modigliani-Miller (1963) show how any stream of income from a levered firm can be achieved from a similarly risky unlevered firm and borrowing by the stockholder on his own personal account. Because the cash return from the two investments is the same, the value of either position must be equal. This allows one to compare the value of the levered firm to the unlevered firm.

Consider a levered firm with assets yielding an uncertain return \tilde{x} , debt B , and an interest rate r . The amount of debt is assumed to be constant over time. An investor who owns a share α of the firm will have an after-tax cash flow of

$$(A-1) \quad C_L = \alpha(\tilde{x} - rB)(1 - \tau_c)(1 - \tau_e).$$

A shareholder in an unlevered firm with the same uncertain return would have an after-tax cash flow of

$$(A-2) \quad C_U = \alpha(\tilde{x})(1 - \tau_c)(1 - \tau_e).$$

If the investor in the unlevered firm borrows an amount equal to $\alpha B(1 - \tau_c)(1 - \tau_e)/(1 - \tau_b)$, the investor's net after-tax cash flow (after deducting the interest payments at τ_b) is identical to C_L .

Since the cash flows from both of these positions are identical, the dollar value of the positions must be identical or there would be unlimited arbitrage profits to be made. If αS_U is the dollar cost of the shares in the unlevered firm, the investor's net capital invested is

$$(A-3) \quad \alpha S_U - \alpha B(1 - \tau_c)(1 - \tau_e)/(1 - \tau_b).$$

The investment in the levered firm, αS_L , must be equal to this amount, or

$$(A-4) \quad S_L = S_U - B(1 - \tau_c)(1 - \tau_e)/(1 - \tau_b).$$

Finally, the total value of the levered firm V_L is the sum of S_L and B , while the value of the unlevered firm V_U is S_U . Substituting for S_L and S_U in equation (A-4) yields,

$$(A-5) \quad V_L - V_U = B[1 - (1 - \tau_c)(1 - \tau_e)/(1 - \tau_b)].$$

This is the increase in the value of the firm from leveraging when $(1 - \tau_b) > (1 - \tau_c)(1 - \tau_e)$.

To give an understanding of the size of the potential increase in the value of the firm from debt finance consider the following parameters: $c = .40$, $\tau_b = .40$, and $\tau_e = .10$. In this case, each unit of capital financed through debt would increase the market value of the levered firm by 10 percent of the value of the capital acquired relative to the unlevered firm.

Appendix B. Rationing with Asymmetric Information

This model assumes that all projects have the same expected return, but both the probability of success p_i and the return if successful R_i^S vary. In such a model, the marginal entrepreneur who is indifferent between undertaking his project and lending at the safe interest rate ρ has the highest probability of success of those projects receiving funding. As a result, increases in the borrowing rate r will cause the best credit risks to drop out. Bank profits may be higher by rationing credit rather than by increasing the rate at which they lend funds. The result that the marginal entrepreneur has the highest probability of success of those projects undertaken is presented here.

The assumption that the expected returns from all projects are identical,

$$(B-1) \quad p_i R_i^S + (1-p_i)R^f = \text{constant},$$

implies that $\partial R_i^S / \partial p_i < 0$.

An entrepreneur will choose to undertake his or her project if the expected profits exceed the return that could be earned by lending one's wealth at the safe interest rate ρ ,

$$(B-2) \quad p_i(R_i^S - (1+r)B) \geq (1 + \rho)w.$$

Note that since $(1+r)B > R^f$, and since equation (B-1) is unaffected by changes in p_i , the left-hand side of equation (B-2) must be decreasing in p_i . Thus, the entrepreneur for whom equation (B-2) holds as an equality has the highest probability of success of those projects undertaken.

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